INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

MODELS

LD801, LD811

AND LD831

MP MASTER

MA28312

LAMBDA

LAMBDA ELECTRONICS CORP.-MELVILLE, L. I., N. Y.

INSTRUCTION MANUAL

FOR

LD SERIES

AC POWER CONDITIONERS

MODELS

LD801, LD811

AND LD831

This manual provides instructions intended for the operation of Lambda power conditioners, and is not to be reproduced without the written consent of Lambda Electronics Corp.

LAMBDA ELECTRONICS CORP. MELVILLE, L.I., N.Y.
MAIN PLANT TELEPHONE: 516-694-4200

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SPECIFICATIONS AND FEATURES

The following specifications apply for both resistive loads and inductive loads, unless otherwise designated. Consult factory for ratings applying to capacitive loads.

INPUT VOLTAGE --

Resistive Load . . . . 100-132 VAC, 57-63 Hz

Inductive Load . . . . 105-132 VAC, 57-63 Hz

OUTPUT VOLTAGE -- 115 VRMS nominal ±5V adjustable; regulated for line and load.

Regulation Line . . . . Less than 1% over the full rated line voltage range.

Regulation Load . . . . Less than 1% for load variations from zero to full load, full-load to zero.

Transient Response (line) . . . Within 50 milliseconds output voltage is constant, within regulation specifications, for any 10% step line-voltage change within rated line voltage.

Transient Response (load) . . . Within 50 milliseconds output voltage is constant within regulation specification for load changes from 0 to full load or full load to 0.

Distortion (Sinusoidal Output). . . Less than 3% introduced by regulator for unity to zero inductive power factor

Temperature Coefficient . . . . Change in output voltage 0.03%/°C

VA OUTPUT RANGE -- VA range must be chosen to suit the appropriate maximum ambient temperature; ratings apply for entire voltage range.

VA RANGE AT AMBIENT OF:

MODEL	40°C	50°C	60°C	71°C
LD801	0-250VA	0-200VA	0-160VA	0-85VA
LD811	0-500VA	0-440VA	0-300VA	0-170VA
LD831	0-1000VA	0-800VA	0-600VA	0-350VA

POWER FACTOR RANGE -- +0.7 P.F. leading, to 0 P.F. lagging.

OVERLOAD PROTECTION --

Thermal . . . . . Thermostat, resets automatically when overtemperature condition is eliminated.

Electrical . . . . . Automatic, electronic current-limiting circuit limits the output to within 140% of the maximum rated output current at short circuit, thereby providing protection for the load as well as the power conditioner.

Internal Failure Protection . . . "SLO-BLO" fuse F1 protects the AC input circuit. Overload of the supply does not cause fuse failure.

REMOTE SENSING -- Provision is made for remote sensing to eliminate effect of power output lead resistance on regulation

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE -- Continuous duty from 0°C to 71°C ambient with corresponding VA ratings for all modes of operation.

STORAGE TEMPERATURE --- -40°C to +85°C
(non-operating)

INPUT AND OUTPUT CONNECTIONS -- Heavy duty terminal block on rear of chassis.

OVERSHOOT -- No overshoot of output voltage under conditions of power turn-on, power turn-off or power failure.

CONTROLS --- Output voltage control . . . Voltage control permits simple screwdriver adjustment of output voltage over entire voltage range.

EFFICIENCY -- Greater than 80% at rated 40°C resistive load and 115VAC input

PHYSICAL DATA

Size	LD801	4-15/16" x 4-15/16"	x 9-3/8"
	LD811	4-15/16" x 7-1/2"	x 9-3/8"
	LD831	4-15/16" x 7-1/2"	x 16-1/2"
Weight	LD801	20 lbs net;	22 lbs. shipping wt.
	LD811	27 lbs net;	30 lbs. shipping wt.
	LD831	47 lbs net;	58 lbs. shipping wt.
Finish	Grey, Fed. Std. 595 No. 26081		

MOUNTING -- Three surfaces, each with tapped mounting holes, can be utilized for mounting the LD-811 and LD-801; the bottom surface of the LD831, with four tapped holes, is used for chassis mounting of the unit. Refer to figures 7 and 8 for cutout details.

ACCESSORY-- Power Cord Adapter LDA-1 is available for use with the LD series AC power conditioner when it is used on a laboratory bench or table top. The adapter permits standard 3-wire plug connection to the LD unit output by means of a 3-wire female receptacle, and to the AC input power source by means of a 3-wire power cord with attached plug. For units with 115 VAC input only.

CIRCUIT DESCRIPTION

GENERAL

The Lambda LD power conditioner, basically an electronic phase-shift device, controls the firing angle of a pair of SCRs, which introduces more or less voltage drop across an SCR-input choke combination, providing a variable voltage to the primary of an autotransformer that boosts the voltage to the required output voltage level. The autotransformer output, filtered by a capacitor and an L-C filter assures low-distortion output wave forms.

Electronic reference, sensing, amplifying, and firing circuitry is provided to compensate for load and line variations. These circuit elements provide for closed-loop action so that remote sensing and automatic electronic output voltage adjustment can be accomplished. In addition, a current limiting circuit is included with a fixed time-delay so that short-duration deviations of input currents do not collapse the output voltage.

The circuit arrangement is shown in block diagram form in figure 5. The circuitry is discussed with reference to the block diagram and the schematic diagram.

FUNCTIONAL DESCRIPTION

Single-phase input power is applied to L1 through the input circuit containing F1, and thermostat S1, which protects the unit against overheating. The main power of the unit is regulated by means of silicon controlled rectifiers SCR1 and SCR2, which are in series with input filter choke L1, and autotransformer T4 and is filtered by C1, and C2, L1 which smooth the voltage applied to the output.

The output voltage is obtained from between the common input, terminal 2 or terminal 5, which are internally connected, and terminal 6 which is connected to autotransformer T4.

Regulation is achieved by controlling the conduction angles of the SCRs. With a conduction angle of 180°, maximum energy is transferred to the load; with a conduction angle of 0°, minimum energy is transferred to the load. A change in the conduction angle of the controlled rectifiers results in a phase shift that is appropriate for the correction of any changes in the output voltage. In actual circuit operation the conduction angle is never 180° or 0°.

A control circuit consisting of sensing elements, voltage reference, comparator, amplifier and SCR firing circuit, controls the regulating action of the SCRs and ultimately the output voltage of the unit.

Full-wave bridge rectifier CR9--CR12 together with R15 and C8 comprise an RMS to DC converter which provides a DC bias voltage for reference zener CR14, driver Q2 amplifier Q4 and comparator Q1, and also provides a feed-back signal to Q2 which is proportional to the RMS value of the output voltage. Zener diode CR14 provides a constant voltage that is divided by dividing network R4, R8, R9 and CR17--CR20 to provide a constant reference voltage at the base of Q1. In addition CR17--CR20 compensate for gain changes in Q1 and Q2 that are caused by temperature variation. Collector current in Q1 is determined by the setting of output voltage adjustment potentiometer R13. The voltage drop across R12, which is porportional to the collector current of Q1, is also determined by the setting of R13. The voltage across R12

is compared to the voltage across R14 by Q2, which also drives output amplifier Q3. Full-wave bridge rectifier CR1--CR4 provides a DC bias voltage for amplifier Q3.

If the output voltage decreases, the base of Q2 is negatively biased causing an increase in the collector current of Q2. This increase in Q2 collector current causes the base drive of Q3 to increase, resulting in an increase of current in the secondary of phase shift transformer T2. Successively, the current then increases in the primary of T2 in R16, C3 and C4. When the voltage drop across C4 exceeds the firing voltage of bilateral switch Q5, Q5 fires, causing a triggering pulse to be transmitted to the primary of pulse transformer T1. This pulse then causes the forward biased SCR to conduct. As the current in the primary of T2 increases the time between the start of the AC input voltage and the triggering pulses decreases, causing the conduction angle to increase. This results in more energy transfer to the output until the output voltage reaches the desired level.

Output current, sensed by resistor R22, is impressed as a voltage across the primary of current transformer T3. The output of T3 is rectified by full-wave bridge rectifier CR5--CR8, providing a D.C. voltage across C9 which is proportional to the load current. When the output current exceeds a predetermined limit value CR15 starts to conduct, causing Q4 to conduct. When Q4 conducts, the base voltage of Q1 decreases resulting in a decrease of Q1 collector current. This causes the base of Q2 to be positively biased, resulting in a decrease in the collector current of Q2. This decrease in Q2 collector current causes the base drive of Q3 to decrease, resulting in a decrease of current in the secondary of phase shift transformer T2. Successively, the current then decreases in the primary of T2 and in R16, C3 and C4. When the voltage drop across C4 exceeds the firing voltage of bilateral switch Q5, Q5 fires, causing a triggering pulse to be transmitted to the primary of pulse transformer T1. This pulse causes the forward biased SCR to conduct. As the current in the primary of T2 decreases the time between the start of the AC input voltage cycle and the triggering pulses increases, causing the conduction angle to decrease. This results in less energy transfer to the output causing the output voltage to decrease until an equilibrium point for voltage and current is reached.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

The AC power conditioner operates as a constant AC voltage source provided the load current does not exceed the maximum current for the rated VA range at 40°C ambient temperature. When load current exceeds this maximum, the voltage decreases and the current increases until voltage reaches zero and the maximum current at short circuit is limited to less than 140% of the current for the rated VA range at the operating ambient temperature of 40°.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connection Always connect ground wire of AC input power to the ground terminal on the rear of the unit.

Connection Terminals Make all connections to the unit at the terminal block on the rear of the unit. Apply input power to terminals 1 and 2; always connect the ungrounded (hot) lead to terminal 1.

The unit AC output is brought out to terminal 6 (hot lead) and to terminal 5 (common). Terminal 5 is internally connected to power terminal 2, which is the AC input power common lead.

> NOTE: When shipped from the factory, the unit is ready for use as a local-sensing constant voltage source. Jumpers are connected at the factory as shown in figure 3. Take care to remove appropriate jumpers for load requirements that need remote sensing connections, figure 4. Refer to the appropriate connection diagram.

Unit-Load Connections The regulation of the unit at the load may change when connecting leads of practical length are used. To minimize the effect of the output load leads, remote sensing is used. Refer to figure 1 to determine voltage drop for particular cable lengths, wire size and current conditions. Lead lengths must be measured from rear terminals to load terminals as shown in figure 2.

Local-Sensing Connection, See Figure 3.

Remote-Sensing Connection, See Figure 4. Maximum combined voltage drop across both load leads must not exceed 2 volts. Voltage drops exceeding this value will reduce voltage delivered to load accordingly.

Sensing leads should be twisted pair to minimize pick-up.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown The thermostat opens the input circuit only when the unit output current exceeds the current for the VA rating specified for operating ambient temperature, causing the temperature of the SCR heat sink to exceed a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to safe operating value. After eliminating the cause(s) for overheating and allowing time for the unit heat sink to cool to a proper temperature, resume operation of the unit.

Fuse Shutdown Internal component failure is prevented by a fuse which protects components from damage caused by exceessive currents. The fuse will clear the input circuit when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

MOUNTING

When using this unit as a mounted component, a cutout must be provided to permit free air flow through the unit. See figure 7 for cutout sizes and specific mounting details

MAINTENANCE

GENERAL

This section describes trouble analysis routine, calibration and test procedures that are useful for servicing the Lambda power conditioner. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on specifications and features for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses, primary power lines, external circuit elements, and external wiring for malfunction before trouble shooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumpers and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 5 as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal no load operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an in-circuit transistor checker. If no checker is available, transistors can be checked with an ohmmeter that has a highly limited current capability. Observe proper polarity for PNP or NPN to avoid error in measurement. The forward transistor resistance is low but never ZERO; backward resistance is always higher than the forward resistance.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional faulty components could damage the replaced component.

When soldering semi-conductor devices, hold the lead being soldered with a pair of pliers or a commercial heat sink device placed between the component and the solder joint.

NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In most cases the capacitors are shunted with resistances, some of which have low values. Only a short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact but not covered with solder it is a good contact. Do not attempt to cover with solder.

2. Voltage measurements can be made from either side of the board. Use a needle-point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to measuring instrument.

3. Always use a heat sink when soldering transistors; a transistor pad with mounting feet is an effective heat sink.

4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.

5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:

   (a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.

   (b) Dip the wick in liquid rosin flux.

   (c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

   (d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

TROUBLE CHART

The trouble chart is intended as a guide for locating trouble causes, and is used along with the schematic diagram.

The operating conditions assumed for the trouble chart are as follows:

(a) AC power of proper voltage and frequency is present at input terminals.

(b) The unit is connected for local sensing operation. See schematic; dotted lines indicate jumpers connected for local sensing operation.

TROUBLE CHART

Symptom	Probable Cause	Remedy
1. No output voltage	No power input; thermostat S1 open; defective fuse F1 or fuse F1 blown	Check power source, line cord and line plug; replace F1; shut off unit, allow to cool and check ambient temperature
	Improper output terminal connections	Refer to appropriate connection diagram and check for correct connections
	SCR1, SCR2 open	Check and replace as required
	C1, C2, C3 or C4 shorted; R16 open; Q5 open or shorted	Check and replace as required

TROUBLE CHART (Cont'd)

	Symptom	Probable Cause	Remedy
2.	Output voltage too high	SCR1, SCR2 shorted	Check and replace as required
		Output connections improper	Refer to appropriate connection diagram and check for correct connections
		R13 improperly adjusted or shorted	Adjust or replace as required
		Q1, Q2, Q3 shorted	Check and replace as required
		Faulty CR9, CR10, CR11 or CR12; shorted CR1, CR2, CR3 or CR4	Check CR9--CR12 for open or short; CR1-CR4 for short and replace as required
3.	Output voltage too low	Improper output connections	Refer to connection diagrams and check for proper connections
		R13 improperly set; R13 faulty	Adjust R13 for proper output voltage; Check R13 for open or short and replace as required
		Q1, Q2, Q3 open	Check and replace as required
		CR9, CR10, CR11 or CR12 open; CR1, CR2, CR3 or CR4 open	Check and replace as required
		R10 open or shorted; CR15, Q4 shorted	Check and replace as required
4.	High distortion present in the output	C1 or C2 open	Check and replace as required
		SCR1 or SCR2 open	Check and replace as required

TROUBLE CHART (Cont'd)

Symptom	Probable Cause	Remedy
5. Excessive audible noise	T4 or L2 shorted	Check and replace as required
	SCR1, SCR2 open	Check and replace as required
6. No current limiting	R22 shorted; T3 open	Check and replace as required
	CR15, Q4 open	Check and replace as required

PERFORMANCE CHECK

Check the output distortion and regulation of the power conditioner using the test connection diagram shown in figure 6. Use the suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the AC differential voltmeter (John Fluke Model 931A or equivalent) to the selected operating voltage. Check the unit load regulation accuracy while switching from the full-load to no-load condition. Long load leads should be a twisted pair to minimize pick-up.

Use a Variac to vary the input voltage from 100 or 105 to 132 or 132 to 100 or 105 volts AC and check the unit line regulation accuracy on the AC differential meter

Use a H-P 333A or equivalent distortion analyzer to measure the distortion of the sinusoidal output of the power conditioner. Set input and output at any voltage within the rated range; connect a load and check the sinusoidal distortion of the output on the distortion analyzer.

NOTE: Output distortion introduced by the power conditioner is expressed as:

$$D_{P.C.} \equiv \sqrt{D^2_{OUT} - D^2_{IN}}$$

Where D^2_{OUT} and D^2_{IN} are measured values obtained from a distortion analyzer

ADJUSTMENT OF CALIBRATION CONTROL R10

Whenever C9, R10, R17, R22 or T3 are replaced and voltage and current indication do not reflect maximum ratings, adjust R10 as follows:

1. Remove AC power input to the unit.

2. Unsolder wiper of R10 from resistor housing, using the wicking process described in printed circuit board maintenance.

3. Turn wiper of R10 to the extreme CCW position

4. Place a fused AC ammeter across output terminals 6 and 5.

5. Operate unit with local sensing, connected as shown in figure 3, with no external load.

6. Adjust R10 until ammeter indicates 135%-140% of maximum rated current.

Calculate this value by substituting in the equation:

$$\text{MAX Rated Current I} = \frac{\text{Rated VA at 40°C}}{110}$$

7. After adjustment is completed, remove AC power input to the unit and solder wiper of R10 to resistor housing

8. After soldering, apply AC input power, check setting and repeat procedure if required

SERVICE

When additional instructions are required or repair service is desired, contact the nearest office of the Lambda Electronics Corp. where trained personnel and complete facilities are ready to assist you.

Please include the unit model and serial number together with complete details of the problem. On receipt of this information, Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power conditioner can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of the unit and purchase date.

2. Lambda part number.

3. Description of part together with circuit designation.

4. If part is not an electronic part, or is not listed, provide a description, function, and location of the part.

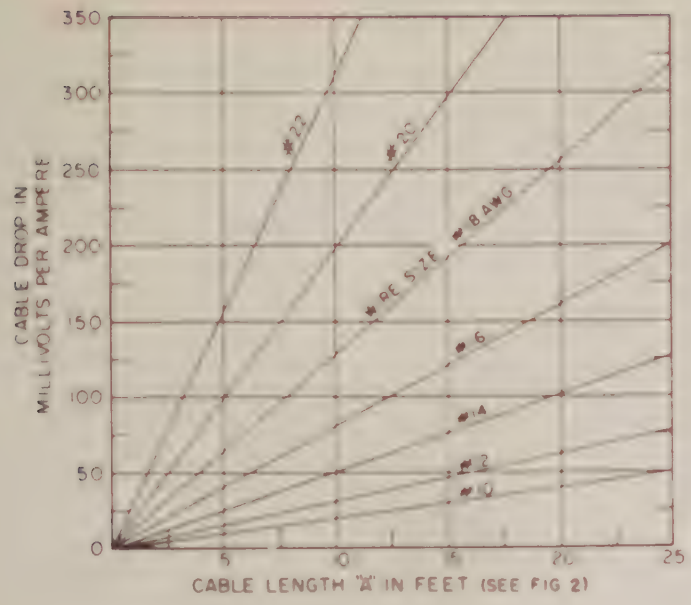


Figure 1. Cable Connection Chart

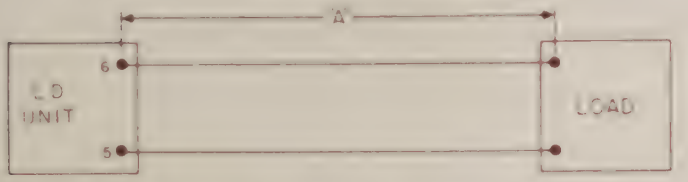
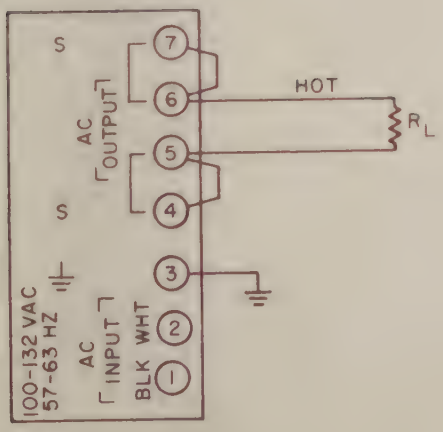
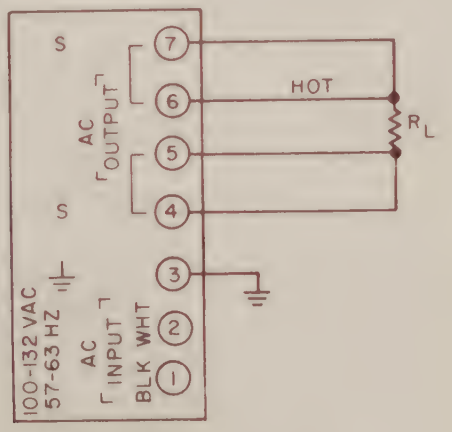


Figure 2. Cable Length "A" in Feet



NOTE:
TERMINALS 2 AND 5 ARE
INTERNALLY CONNECTED

Figure 3. Local Sensing Connections



NOTE:
TERMINALS 2 AND 5 ARE
INTERNALLY CONNECTED

Figure 4. Remote Sensing Connections

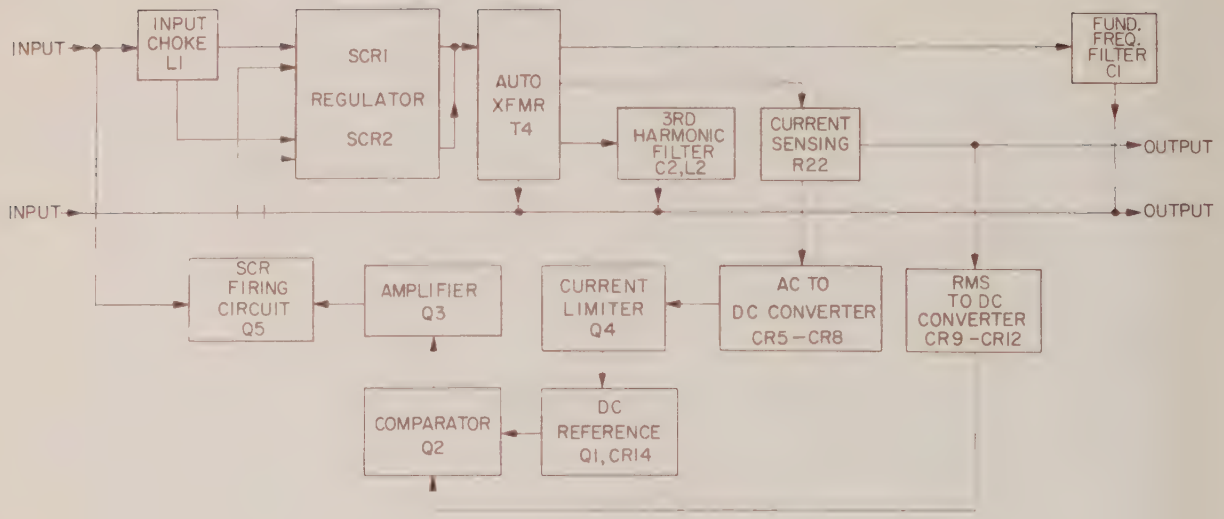
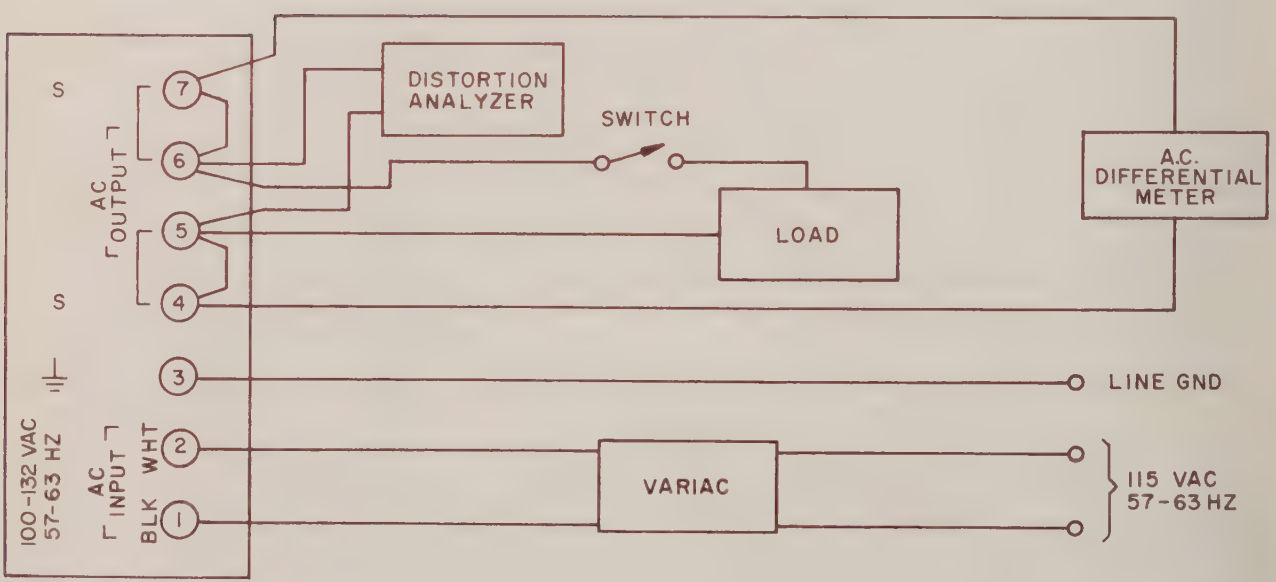


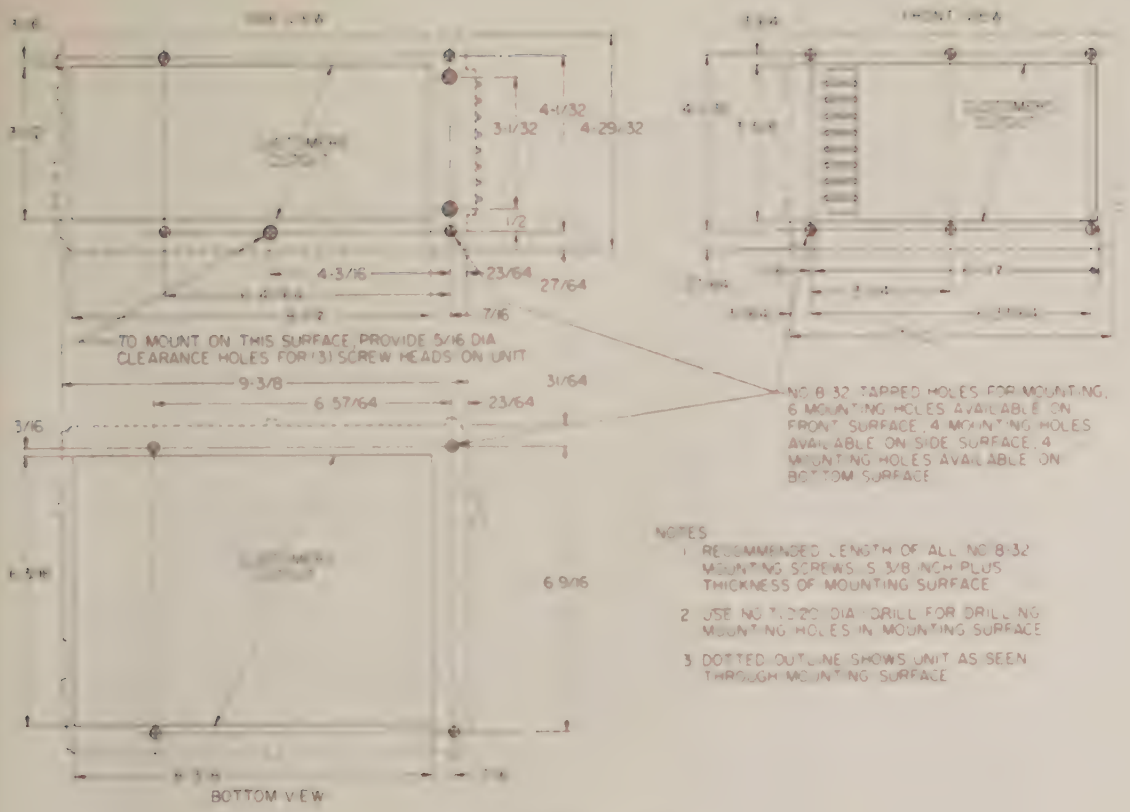
Figure 5. Typical Block Diagram



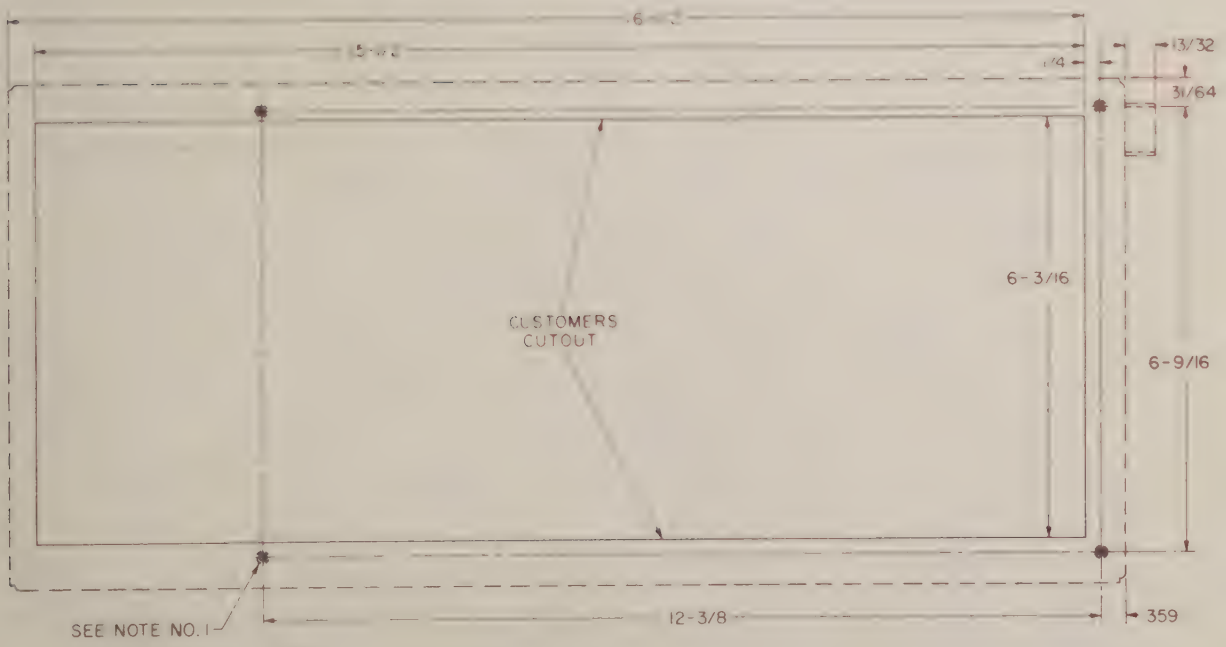
NOTES:

1. DISTORTION ANALYZER AND DIFFERENTIAL METER MUST NOT BE GROUNDED THROUGH 3-WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY.

Figure 6. Test Connections for Performance Checks


4-1/32
3-1/32
4-29/32
1/2
4-3/16
23/64
27/64
7/16
TO MOUNT ON THIS SURFACE, PROVIDE 5/16 DIA CLEARANCE HOLES FOR (3) SCREW HEADS ON UNIT
9-3/8
6 57/64
23/64
31/64
3/16
6 9/16
BOTTOM VIEW
NO. 8-32 TAPPED HOLES FOR MOUNTING. 6 MOUNTING HOLES AVAILABLE ON FRONT SURFACE, 4 MOUNTING HOLES AVAILABLE ON SIDE SURFACE, 4 MOUNTING HOLES AVAILABLE ON BOTTOM SURFACE
NOTES
1 RECOMMENDED LENGTH OF ALL NO 8-32 MOUNTING SCREWS IS 3/8 INCH PLUS THICKNESS OF MOUNTING SURFACE
2 USE NO 7 (.201 DIA) DRILL FOR DRILLING MOUNTING HOLES IN MOUNTING SURFACE
3 DOTTED OUTLINE SHOWS UNIT AS SEEN THROUGH MOUNTING SURFACE

(a) MODEL LD811



NOTES:
1. NO. 8-32 TAPPED HOLES (4) ON BOTTOM SURFACE FOR CUSTOMER CHASSIS MOUNTING. RECOMMENDED LENGTH OF ALL NO. 8-32 MOUNTING SCREWS IS 3/8 INCH PLUS THICKNESS OF MOUNTING SURFACE.
2. USE NO. 7 (0.201 DIA.) DRILL FOR DRILLING MOUNTING HOLES IN MOUNTING SURFACE.
3. DOTTED OUTLINE SHOWS UNIT AS SEEN THROUGH MOUNTING SURFACE.

BOTTOM VIEW

(b) MODEL LD831

Figure 7. Recommended Mounting Cutouts, LD811 and LD831

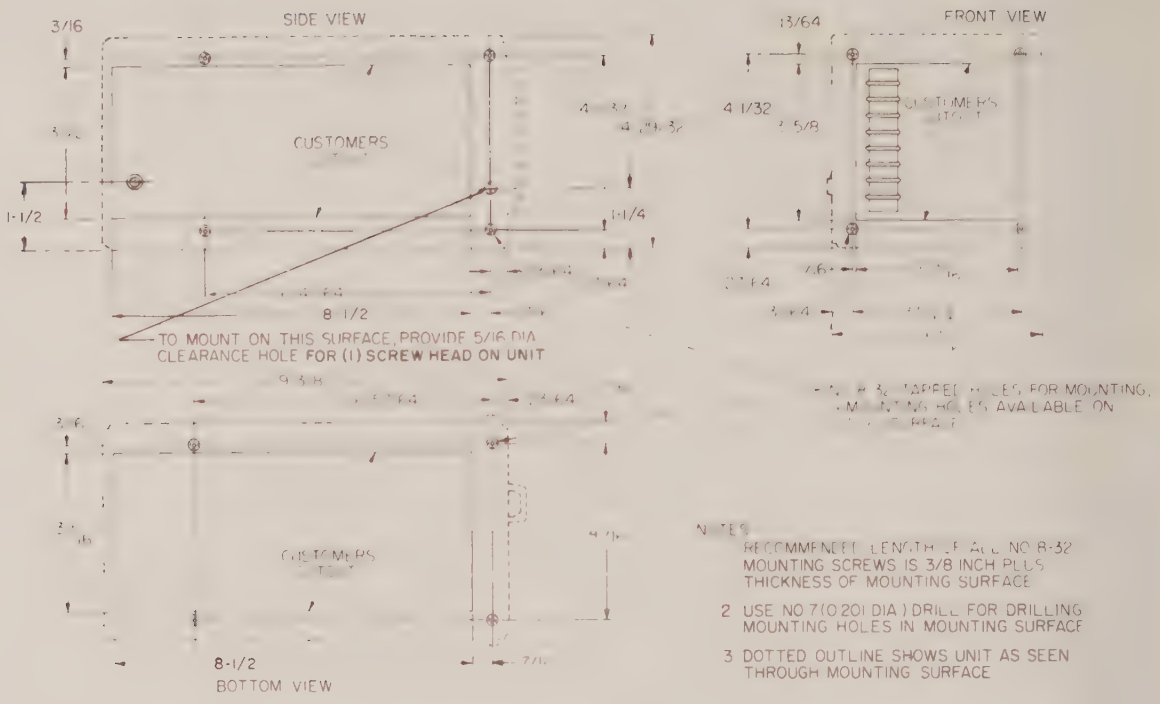
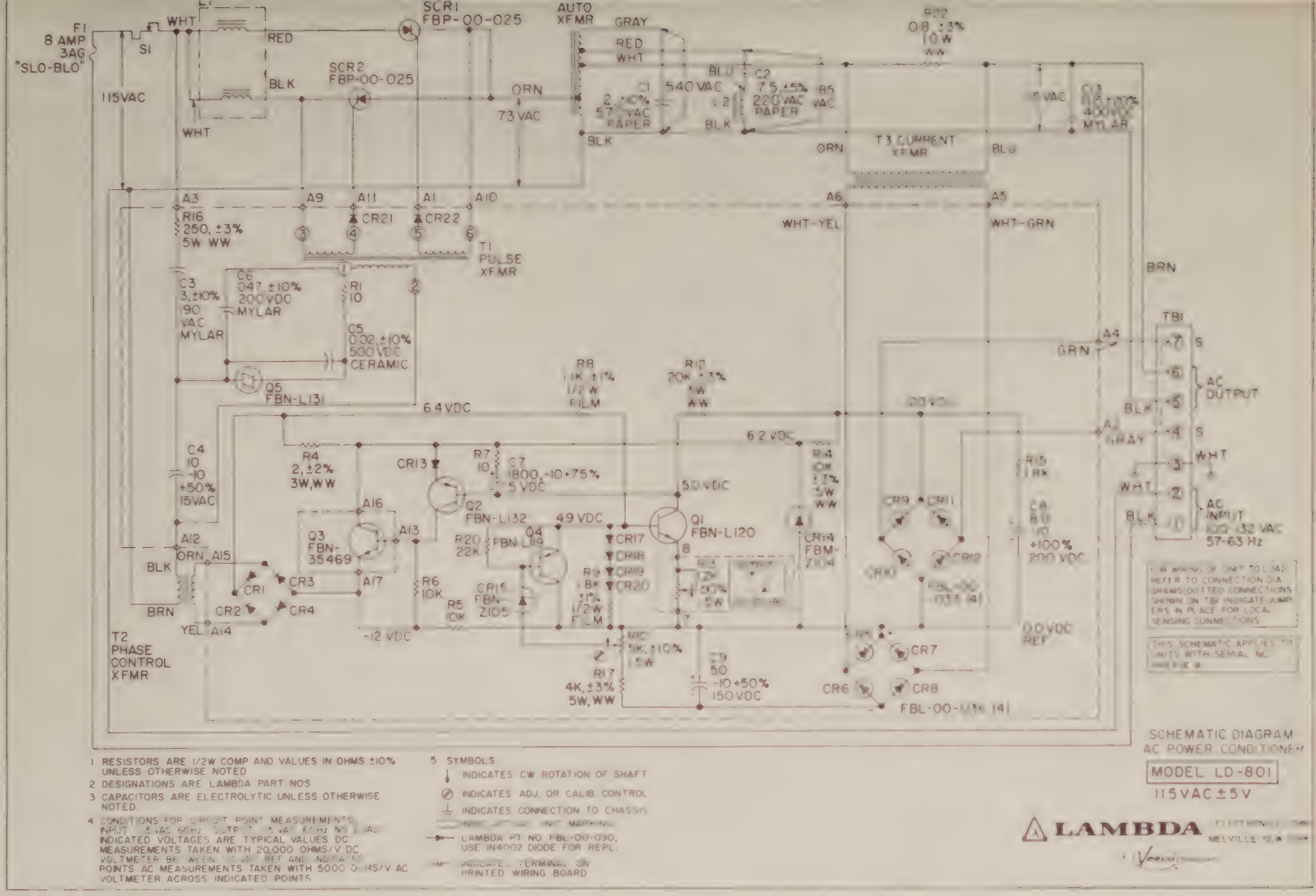


Figure 8. Recommended Mounting Cutouts, LD801



1 RESISTORS ARE 1/2W COMP AND VALUES IN OHMS ±10% UNLESS OTHERWISE NOTED

2 DESIGNATIONS ARE LAMBDA PART NOS

3 CAPACITORS ARE ELECTROLYTIC UNLESS OTHERWISE NOTED.

4 CONDITIONS FOR OUTPUT POINT MEASUREMENTS INPUT 115 VAC 60Hz OUTPUT 5 VDC FULL LOAD INDICATED VOLTAGES ARE TYPICAL VALUES DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V DC VOLTMETER BETWEEN +S OR REF AND NO CAL POINTS AC MEASUREMENTS TAKEN WITH 5000 OHMS/V AC VOLTMETER ACROSS INDICATED POINTS

5 SYMBOLS

INDICATES CW ROTATION OF SHAFT

INDICATES ADJ. OR CALIB. CONTROL

INDICATES CONNECTION TO CHASSIS

LAMBDA PT. NO FBL-00-030, USE IN4002 DIODE FOR REPL.

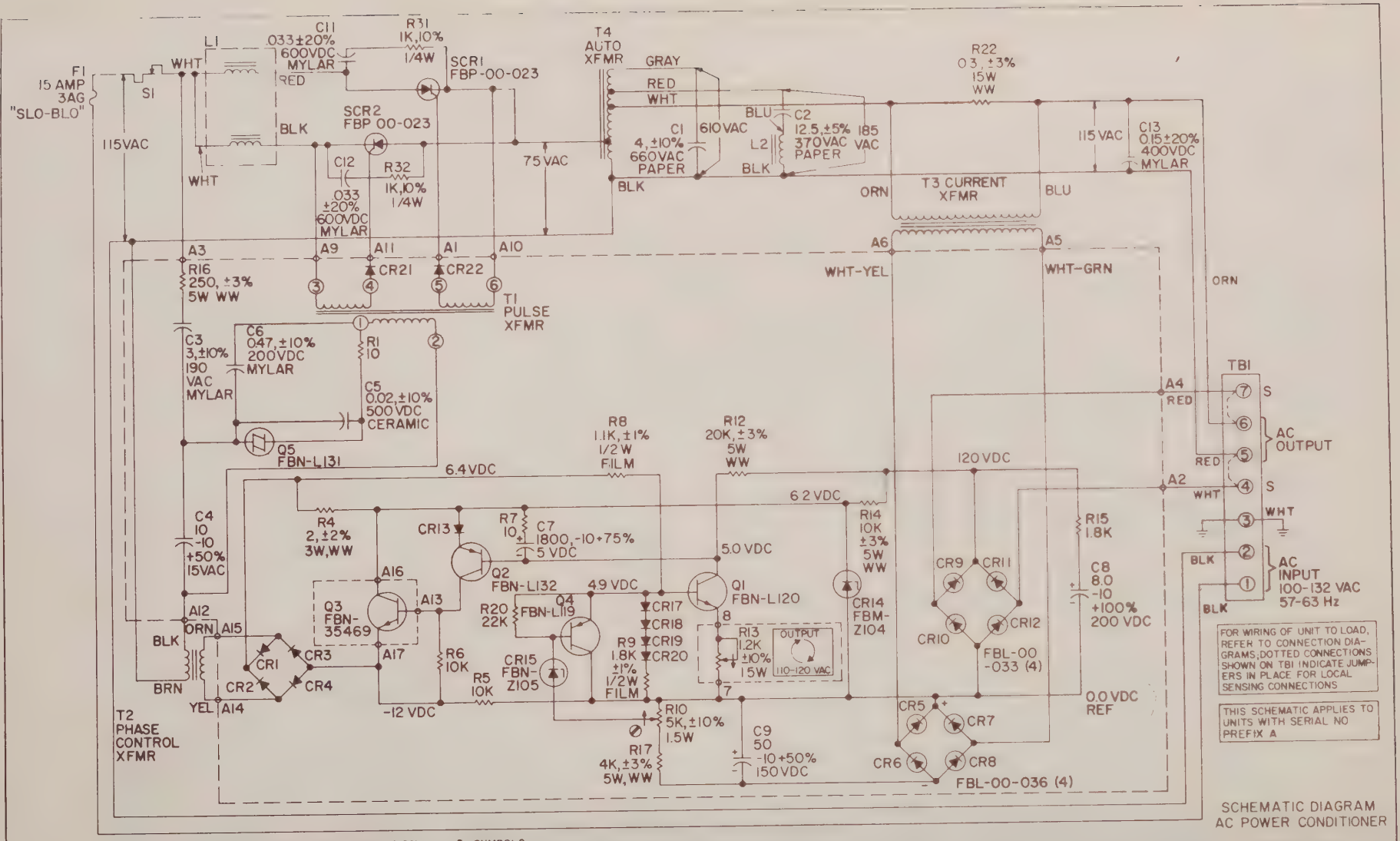
INDICATES TERMINAL ON PRINTED WIRING BOARD

SCHEMATIC DIAGRAM
AC POWER CONDITIONER

MODEL LD-801

115VAC ±5V

LAMBDA



SCHEMATIC DIAGRAM
AC POWER CONDITIONER

MODEL LD-811
115VAC±5V

1. RESISTORS ARE 1/2W COMP AND VALUES IN OHMS ±10% UNLESS OTHERWISE NOTED.
2. DESIGNATIONS ARE LAMBDA PART NOS.
3. CAPACITORS ARE ELECTROLYTIC UNLESS OTHERWISE NOTED
4. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS; INPUT: 115 VAC 60Hz; OUTPUT: 115 VAC 60Hz NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V DC VOLTMETER BETWEEN 0.0 VDC REF AND INDICATED POINTS AC MEASUREMENTS TAKEN WITH 5000 OHMS/V AC VOLTMETER ACROSS INDICATED POINTS
5. SYMBOLS
   - INDICATES CW ROTATION OF SHAFT
   - INDICATES ADJ. OR CALIB. CONTROL
   - INDICATES CONNECTION TO CHASSIS
   - INDIC. ACTUAL UNIT MARKING
   - LAMBDA PT NO. FBL-00-030, USE IN4002 DIODE FOR REPL.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD.

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MELVILLE NEW YORK
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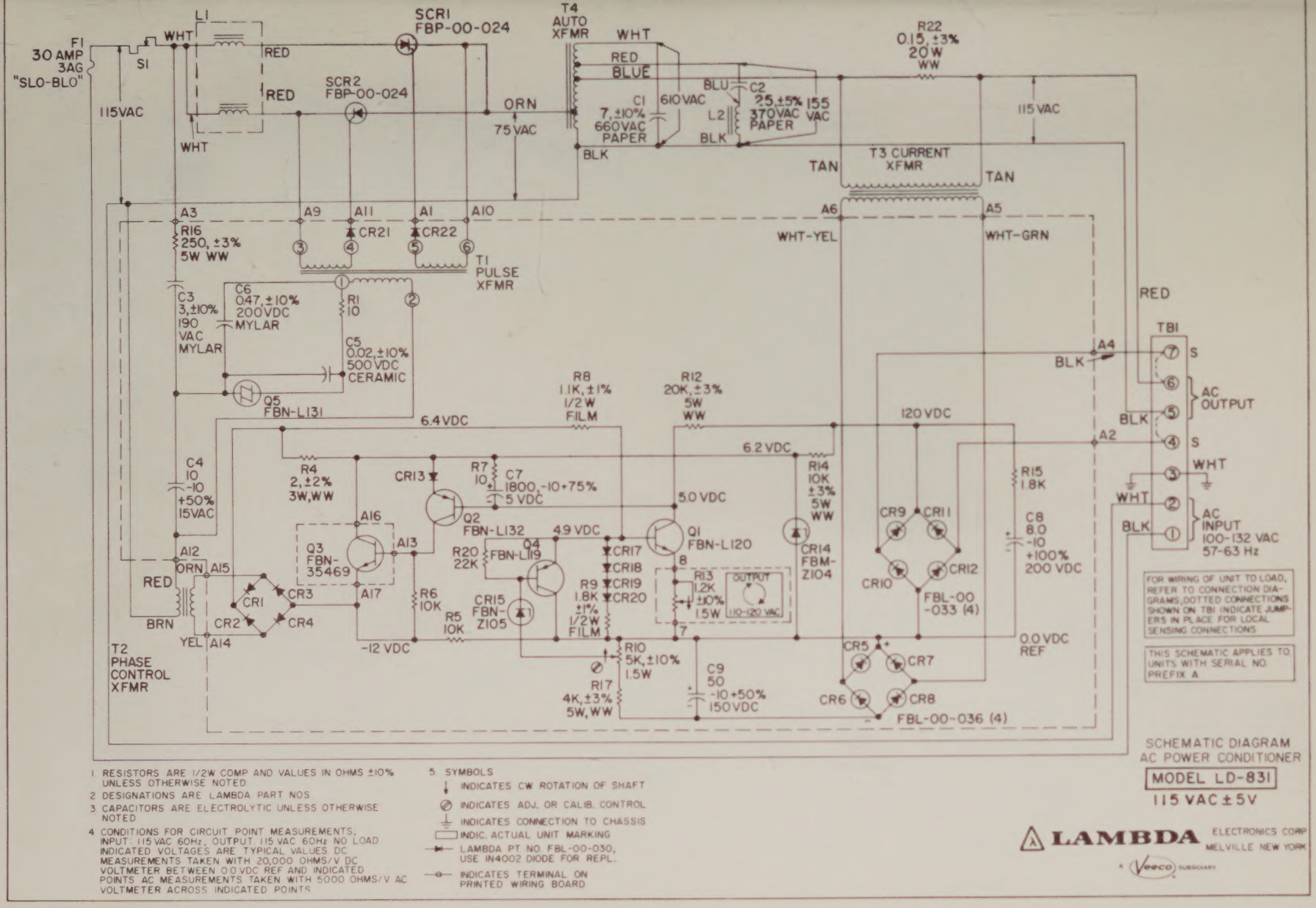

1. RESISTORS ARE 1/2W COMP AND VALUES IN OHMS ±10% UNLESS OTHERWISE NOTED.
2. DESIGNATIONS ARE LAMBDA PART NOS.
3. CAPACITORS ARE ELECTROLYTIC UNLESS OTHERWISE NOTED.
4. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS; INPUT: 115 VAC 60Hz, OUTPUT 115 VAC 60Hz NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V DC VOLTMETER BETWEEN 0.0 VDC REF AND INDICATED POINTS. AC MEASUREMENTS TAKEN WITH 5000 OHMS/V AC VOLTMETER ACROSS INDICATED POINTS.

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SCHEMATIC DIAGRAM
AC POWER CONDITIONER
MODEL LD-831
115 VAC ±5V

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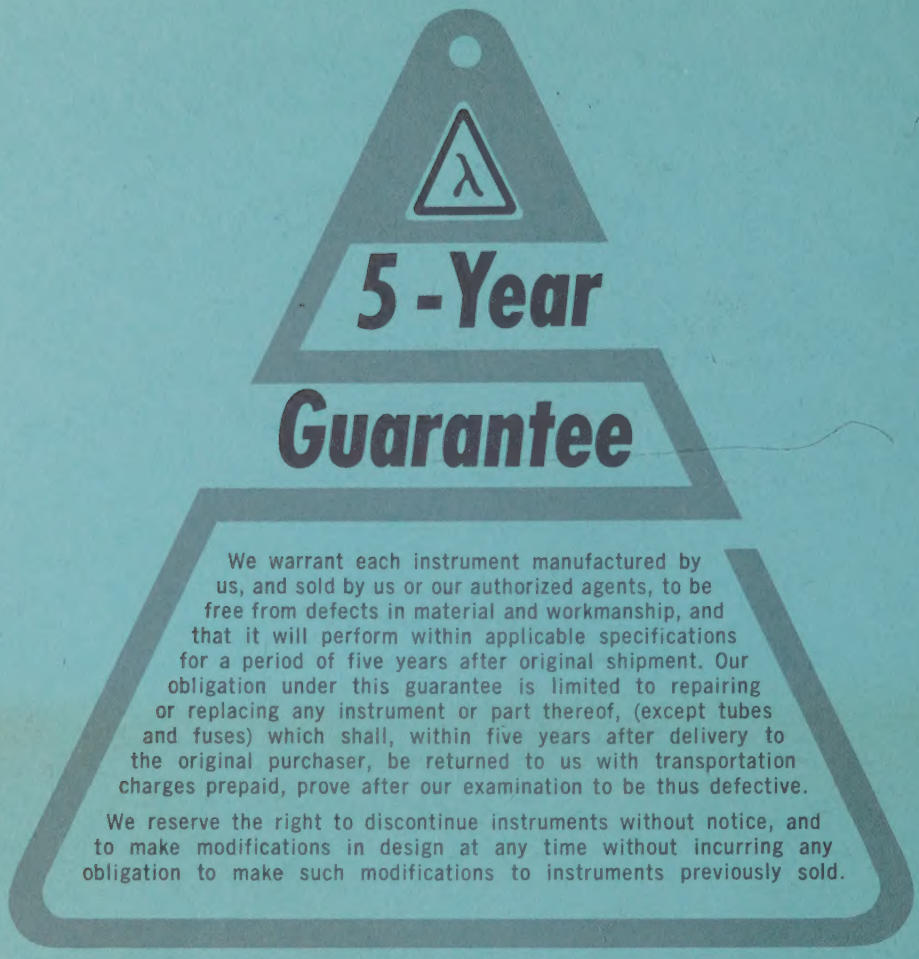
5 -Year
Guarantee
We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.
We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.

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